(3) 10 MHz maximum authorized bandwidth channels:

TRANSMIT (receive) (MHZ)	RECEIVE (transmit) (MHZ)
10855	11345

(4) 5 MHz maximum authorized bandwidth channels:

TRANSMIT (receive) (MHZ)	RECEIVE (transmit) (MHZ)
11132.5	11622.5
11137.5	11627.5
11142.5	11632.5
11147.5	11637.5
11152.5	11642.5
11157.5	11647.5
11162.5	11652.5
11167.5	11657.5
11172.5	11662.5
11177.5	11667.5
11182.5	11682.5
11187.5	11687.5
11192.5	11692.5
11197.5	11697.5

(5) 3.75 MHz maximum authorized bandwidth channels:

TRANSMIT (receive) (MHZ)	RECEIVE (transmit) (MHZ)
11133.125	11623.125
11138.125	11628.125
11143.125	11633.125
11148.125	11638.125
11153.125	11643.125
11158.125	11648.125
11163.125	11653.125
11168.125	11658.125
11173.125	11663.125
11178.125	11668.125
11183.125	11683.125
11188.125	11688.125
11193.125	11693.125
11198.125	11698.125

(6) 2.5 MHz maximum authorized bandwidth channels:

TRANSMIT (receive) (MHZ)	RECEIVE (transmit) (MHZ)
11131.25	11621.25
11133.75	11623.75
11136.25	11626.25
11138.75	11628.75
11141.25	11631.25
11143.75	11633.75
11146.25	11636.25
11148.75	11638.75
11151.25	11641.25
11153.75	11643.75
11156.25	11646.25
11158.75	11648.75
11161.25	11651.25
11163.75	11653.75
11166.25	11656.25
11168.75	11658.75
11171.25	11661.25
11173.75	11663.75
11176.25	11666.25
11178.75	11668.75
11181.25	11681.25
11183.75	11683.75
11186.25	11686.25
11188.75	11688.75
11191.25	11691.25
11193.75	11693.75
11196.25	11696.25
11198.75	11698.75

(7) 1.25 MHz maximum authorized bandwidth channels:

TRANSMIT (receive) (MHZ)	RECEIVE (transmit) (MHZ)
11130.625	11620.625
11131.875	11621.875
11133.125	11623.125
11134.375	11624.375
11135.625	11625.625
11136.875	11626.875
11138.125	11628.125
11139.375	11629.375
11140.625	11630.625
11141.875	11631.875
11143.125	11633.125
11144.375	11634.375
11145.625	11635.625
11146.875	11636.875
11148.125	11638.125
11149.375	11639.375
11150.625	11640.625
11151.875	11641.875
11153.125	11643.125
11154.375	11644.375
11155.625	11645.625
11156.875	11646.875
11158.125	11648.125
11159.375	11649.375
11160.625	11650.625
11161.875	11651.875
11163.125	11653.125
11164.375	11654.375
11165.625	11655.625
11166.875	11656.875
11168.125	11658.125
11169.375	11659.375
11170.625	11660.625
11171.875	11661.875
11173.125	11663.125
11174.375	11664.375
11175.625	11665.625

(7) 1.25 MHz maximum authorized bandwidth channels:

TRANSMIT (receive) (MHZ)	RECEIVE (transmit) (MHZ)
11176.875	11666.875
11178.125	11668.125
11179.375	11669.375
11180.625	11680.625
11181.875	11681.875
11183.125	11683.125
11184.375	11684.375
11185.625	11685.625
11186.875	11686.875
11188.125	11688.125
11189.375	11689.375
11190.625	11690.625
11191.875	11691.875
11193.125	11693.125
11194.375	11694.375
11195.625	11695.625
11196.875	11696.875
11198.125	11698.125
11199.375	11699.375

(l) * * * (formerly (h))

(m) * * * (formerly (j))

(n) * * * (formerly (k))

(o) * * * (formerly (l))

(p) * * * (formerly (m))

Section 94.67 Frequency tolerance.

Stations in this service shall maintain the carrier frequency of each authorized transmitter to within the following percentage of the assigned frequency:

Frequency Band (MHz)	Tolerance as a percentage of assigned frequency	
928.0 to 929.0	0.0005	(8)
932.0 to 932.5, 941.0 to 941.5	0.00015	
932.5 to 935.0, 941.5 to 944.0	0.00025	
952.0 to 960.0		(1) (4)
1,850 to 1,990	0.002	
2,130 to 2,150	0.001	
2,150 to 2,160	0.001	
2,180 to 2,200	0.001	
2,450 to 2,500	0.001	
3,700 to 4,200	0.005	(9)
5,925 to 6,425	0.005	(9)
6,425 to 6,525	0.005	
6,525 to 6,875	0.005	
10,550 to 10,680	0.005	(7)
10,700 to 11,700	0.005	(9)
12,200 to 13,150	0.005	(2)
13,200 to 13,250	0.03	
17,700 to 18,820	0.003	(6)
18,820 to 18,920	0.001	
18,920 to 19,700	0.003	(6)
21,200 to 23,600	0.03	(5)
31,000 to 31,300	0.03	
31,300 to 40,000	0.03	

Footnotes (1) to (6) * * *

(7) - Digital Termination System transmitters must maintain frequency tolerances to within 0.0003 percent.

(8) - * * *

(9) - For exceptions, see section 21.101(a).

Section 94.71 Emission and bandwidth limitations.

* * * * *

(b) The maximum bandwidth that will be authorized per frequency is set out in the table that follows. Regardless of the maximum authorized bandwidth specified for each frequency band, the Commission reserves the right to issue a license for less than the maximum bandwidth if it appears that a lesser bandwidth would be sufficient to support an applicant's intended communications.

Frequency Band (MHz)	Maximum authorized bandwidth		
928.0 to 929.0	12.5, 25 kHz	(1)	(7)
932.0 to 932.5, 941.0 to 941.5	12.5 kHz	(1)	
932.5 to 935.0, 941.5 to 944.0	25, 50, 100, 200 kHz	(1)	
952.0 to 960.0	12.5, 25, 50, 100, 200 kHz	(1)	(6)
1,850 to 1,990	5 or 10 MHz	(1)	
2,130 to 2,150	800, 1600 kHz	(1)	
2,150 to 2,160	10 MHz		
2,180 to 2,200	800, 1600 kHz	(1)	
2,450.0 to 2,483.5	625 kHz	(2)	
2,483.5 to 2,500.0	800 kHz		
3,700 to 4,200	20 MHz	(1)	
5,925 to 6,425	30 MHz	(1)	
6,425 to 6,525	25 MHz		
6,525 to 6,875	10 MHz	(1)	
10,550 to 10,680	5 MHz	(1)	
10,700 to 11,700	40 MHz	(1)	
12,200 to 12,700	10 or 20 MHz	(1)	
13,200 to 13,250	25 MHz		
17,700 to 18,140	80 MHz		
18,140 to 18,142	2 MHz		
18,142 to 18,580	6 MHz		
18,580 to 18,820	20 MHz		
18,820 to 18,920	10 MHz		
18,920 to 19,160	20 MHz		
19,160 to 19,260	10 MHz		
19,260 to 19,700	80 MHz		
21,200 to 23,600	up to 100 MHz	(5)	
31,000 to 31,300	25 or 50 MHz		
38,600 to 40,000	up to 50 MHz		
Bands above 40,000 MHz		(4)	

* * * * *

94.73 Power limitations.

(a) On any authorized frequency, the average power delivered to an antenna in this service shall be the minimum amount of power necessary to carry out the communications desired. Application of this principle shall include, but not be limited to, requiring a licensee who replaces one or more of his antennas with larger antennas to reduce his antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. Further, the output power of a transmitter on any authorized frequency in this service shall not exceed the following:

Frequency Band (MHz)	Maximum allowable transmitter power		Maximum allowable EIRP (2)	
	Fixed (W)	Mobile (W)	Fixed (dBW)	Mobile (dBW)
928.0 to 929.0	5.0	.....	+17	.....
932.0 to 932.5	.....	.....	+17	.....
932.5 to 935.0	20.0	.....	+40	.....
941.0 to 941.5	.....	.....	+30	.....
941.5 to 944.0	20.0	.....	+40	.....
952.0 to 960.0	20.0 (2)	.....	+40 (3)	.....
1,850 to 1,990	20.0	.....	+45	.....
2,130 to 2,150	20.0	.....	+45	.....
2,150 to 2,160	20.0	.....	+45 (3)	.....
2,180 to 2,200	20.0	.....	+45	.....
2,450 to 2,500	20.0	.....	+45	.....
3,700 to 4,200	20.0	.....	+55 (9)	.....
5,925 to 6,425	20.0	.....	+55	.....
6,425 to 6,525	.....	20.0	.....	+35
6,525 to 6,875	20.0	.....	+55	.....
10,550 to 10,680	10.0 (5)	.....	+55	.....
10,700 to 11,700	10.0	.....	+55 (9)	.....
12,200 to 12,700	10.0	.....	+50 (4)	.....
12,700 to 13,250	10.0	.....	+50	.....
17,700 to 18,600	10.0	.....	+55	.....
18,600 to 18,800	10.0 (6)	.....	+35	.....
18,800 to 19,700	10.0	.....	+55	.....
21,200 to 23,600	10.0	.....	+40	.....
31,000 to 31,300	0.05	0.05	.....	.....
38,600 to 40,000	10.0	.....	+40	.....

Footnotes (1) to (8) * * *

(9) - Stations authorized or pending on *[Report and Order date]* need not comply with this standard.

94.75 Antenna limitations.

* * * * *

(b) Directional antennas shall meet the performance standards (for parallel polarization) indicated in the following table:

ANTENNA STANDARDS

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points (included angle in degrees)	Minimum antenna gain (dBi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
932.5 to 935.0	A	14.0	NA	...	6	11	14	17	20	24
941.5 to 944.0	B	20.0	NA	.....	6	10	13	15	20	
952.0 to 960.0	A	14.0	NA	...	6	11	14	17	20	24
(1) (4)	B	20.0	NA	.....	6	10	13	15	20	
1,850 to 2,500	A	5.0	36.0	12	18	22	25	29	33	39
(2)	B	8.0	36.0	5	18	20	20	25	28	36
3,700 to 4,200	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
5,925 to 6,425	A	NA	38.0	25	29	33	36	42	55	55
(10)	B	NA	38.0	21	25	29	32	35	39	45
6,525 to 6,875	A	NA	38.0	25	29	33	36	42	55	55
(10)	B	NA	38.0	21	25	29	32	35	39	45
10,550 to 10,680	A	NA	38.0	25	29	33	36	42	55	55
(3) (10)	B	NA	38.0	20	24	28	32	35	35	39
10,700 to 11,700	A	NA	38.0	25	29	33	36	42	55	55
(10)	B	NA	38.0	20	24	28	32	35	35	39
12,200 to 13,250	A	1.0	NA	23	28	35	39	41	42	50
(6)	B	2.0	NA	20	25	28	30	32	37	47
17,700 to 19,700	A	NA	38.0	25	29	33	36	42	55	55
(3)	B	NA	38.0	20	24	28	32	35	36	36
21,200 to 23,600	A	NA	38.0	25	29	33	36	42	55	55
(5)	B	NA	38.0	20	24	28	32	35	36	36

ANTENNA STANDARDS - Continued

Frequency (MHz)	Category	Maximum beam-width to 3 dB points (included angle in degrees)	Minimum antenna gain (dBi)	Minimum radiation suppression to angle in degrees from center-line of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
27,500 to 29,500	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
31,000 to 31,300 (7) (8)	NA	4.0	38.0	NA	NA	NA	NA	NA	NA	NA
38,600 to 40,000	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
5,925 to 6,425 (11)	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
6,525 to 6,875 (11)	A	1.5	NA	26	29	32	34	38	41	49
	B	2.0	NA	21	25	29	32	35	39	45
10,550 to 10,680 (3) (9) (11)	A	3.4	34.0	20	24	28	32	35	55	55
	B	3.4	34.0	20	24	28	32	35	35	39

Footnotes (1) to (9) * * *

(10) - These antenna standards apply to all stations authorized after ***[Report and Order date + 3.5 years]***. Existing licensees and pending applicants on that date are grandfathered and need not comply with these standards.

(11) - These antenna standards apply to all stations authorized or pending before ***[Report and Order date + 3.5 years]***.

* * * * *

(h) Antennas requirements for point-to-multipoint transmitters in the 10,550-10,680 MHz and 17,700-19,700 MHz bands, excluding operations under Section 94.88, are as follows:

(1) Nodal transmitting antennas may be omnidirectional or directional, consistent with coverage and interference requirements. The antenna standards of paragraph (b) in this section do not apply to nodal transmitting antennas.

(2) * * *

(3) Directive antennas shall be used at all user stations and

Section 94.79 Minimum path lengths for fixed links.

(a) The distance between end points of a fixed link must equal or exceed the value set forth in the table below or the EIRP must be reduced in accordance with the equation set forth in paragraph (b) of this section.

Frequency Band (MHz)	Minimum path length (Km)
Below 1,850	n/a
1,850 to 7,125	17
10,550 to 13,250	5
Above 17,700	n/a

(b) For paths shorter than those specified in the Table, the EIRP shall not exceed the value derived from the following equation:

EIRP = 35 - 20 log(A/B), dBW

Where:

EIRP = Equivalent isotropic radiated power in dBW.
A = Minimum path length from the Table for the frequency band in kilometers.
B = The actual path length in kilometers.

NOTE: *Automatic Transmit Power Control (ATPC)* may be used to meet this requirement.

* * * * *

Section 94.94 Microwave digital modulation.

(a) Microwave transmitters employing digital modulation techniques in the 10,550-10,680 MHz and 17,700-19,700 MHz bands shall transmit at a bit rate, in bits per second (bps), equal to or greater than the authorized bandwidth in Hertz (e.g., to be acceptable, equipment transmitting at a 20 Mbps rate must not require an authorized bandwidth greater than 20 MHz). This bps/Hz standard is independent of the antenna (polarization) used, frequency reuse, or how the system is configured.

NOTE: Systems authorized in the 17,700-19,700 MHz band prior to December 1, 1988 may install equipment with no minimum bit rate.

(b) Stations authorized after ***[Report and Order date + 3.5 years]*** in the 6,525-6,875 MHz and 10,550-10,680 MHz bands shall meet the minimum payload capacity and traffic loading requirements of sections 21.122(a), 21.123(a), and 21.124. Systems authorized or pending before that date are grandfathered and need not comply with these requirements.

APPENDIX B

CURRENT FCC RULES AND REGULATIONS

47 CFR Parts 2, 21, 22, and 94

Revised October 1, 1992

Subpart C—Technical Standards

§ 21.100 Frequencies.

(a) The frequencies available for use in the services covered by this part of the rules are listed in the applicable subparts of this part. Assignment of frequencies will be made only in such a manner as to facilitate the rendition of communication service on an interstate basis. Except as provided in paragraph (b) of this section, where a substantial showing is made that a total of three working channels will be required within 3 years, a protection channel may be authorized simultaneously with the first working channel. A protection channel authorized under such exception will be subject to termination if applications for the third working channel are not filed within 3 years of the grant date of the

ligated to suggest changes or re-engineer a proposal in cases involving conflicts. Applicants should make every reasonable effort to avoid blocking the growth of systems that are likely to need additional capacity in the foreseeable future. The applicant shall identify in the application all entities with which the technical proposal was coordinated. In the event that technical problems are not resolved or if the existing licensee, or applicant does not repond to coordination efforts within 30 days after notification, an explanation shall be submitted with the application. Where technical problems are resolved by an agreement or operating arrangement between the parties that would require special procedures be taken to reduce the likelihood of interference in excess of permissible levels (such as the use of artificial site shielding) or would result in a reduction of quality or capacity of either system, the details thereof shall be contained in the application.

(2) *Coordination procedure guide-*

Receiving antenna type and model and, if required, a typical pattern and maximum gain.
Receiving antenna height above ground level and ground elevation above mean sea level.
Path azimuth and distance.

(iii) For transmitters employing digital modulation techniques at frequencies below 15 GHz, the notification should clearly identify the type of modulation. Upon request, additional details of the operating characteristics of the equipment shall also be furnished.

(iv) Response to notification should be made as quickly as possible, even if no technical problems are anticipated. Every reasonable effort should be made by all applicants, permittees and licensees to eliminate all problems and conflicts. If no response to notification is received within 30 days, the applicant will be deemed to have made reasonable efforts to coordinate and may file its application without a response.

(v) The 30-day notification period is

are not numerous or complex, the carrier receiving the changed notification should make an effort to respond in less than 30 days. When the notifying carrier believes a shorter response time is reasonable and appropriate, it may be helpful for that carrier to so indicate in the notice and perhaps suggest a response date.

(viii) If, after coordination is successfully completed, it is determined that a subsequent change could have no impact on some carriers receiving the original notification, it is not necessary to coodinate the change with such carriers. However, these carriers shall be notified of the change and the opinion that coordination is not required for such change.

(ix) Applicants, permittees and licensees should supply to all other applicants, permittees and licensees, or known applicants, within their areas of operations, the name, address and telephone number of their coordination representatives. Upon request from coordinating applicants, permittees and licensees, data and information concerning existing or proposed facilities and future growth plans in the area of interest should be furnished unless such request is unreasonable or would impose a significant burden in compilation.

(x) Carriers should keep other carriers with whom they are coordinating advised of changes in plans for facilities previously coordinated. If applications have not been filed 6 months after coordination was initiated, carriers may assume that such frequency use is no longer desired unless a second notification has been received within 10 days of the end of the 6 month period. Renewal notifications are to be sent to all originally notified parties, even if coordination has not been successfully completed with those parties.

(e) Where frequency conflicts arise between co-pending applications in the Point-to-Point Microwave Radio and Local Television Transmission Services, it shall be the obligation of the later filing applicant to amend his application to remove the conflict, unless he can make a showing that the conflict cannot be reasonably eliminated. Where a frequency conflict is not resolved and no showing is submitted as to why the conflict cannot be resolved, the Commission may grant the first filed application and dismiss the later filed application(s) after giving the later filing applicant(s) 30 days to respond to the proposed action.

[44 FR 60534, Oct. 19, 1979, as amended at 47 FR 29244, July 6, 1982; 50 FR 7340, Feb. 22, 1985; 52 FR 27555, July 22, 1987; 52 FR 37782, Oct. 9, 1987]

§ 21.107 Transmitter power.

(a) The power which a station will be permitted to use in these services will be the minimum required for satisfactory technical operation commensurate with the size of the area to be served and local conditions which affect radio transmission and reception. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of a station.

(b) The rated power of a transmitter employed in these radio services shall not exceed the values shown in the following tabulation:

Frequency band (MHz)	Maximum allowable transmitter power		Maximum allowable EIRP	
	Fixed (W)	Mobile (W)	Fixed (dBW)	Mobile (dBW)
512 to 2,110	20.0	20.0	(4)	
932.5 to 935	20.0		+40	
941.5 to 944	20.0		+40	
2,110 to 2,130	20.0			
2,150 to 2,160	[1]20.0		+45	
2,160 to 2,180	[1]20.0			
2,500 to 2,686	[1]10.0			
2,686 to 2,690	0.25			
3,700 to 4,200	20.0			
5,925 to 6,425	20.0		+55	
6,425 to 6,525		20.0		-35
10,550 to 10,565	10.0			
10,615 to 10,630	10.0		[2]	
10,700 to 11,200	10.0			
12,200 to 13,250	10.0	10.0		
17,700 to 18,600	10.0		+55	
18,600 to 18,800	[3]10.0		+35	
18,800 to 19,700	10.0		+55	
21,200 to 23,600	10.0		+50	
27,500 to 29,500	10.0		55	
31,000 to 31,300	0.05	0.05		
38,600 to 40,000	10.0	1.5	50	

[1] In the 2150-2162 MHz, 2596-2644 MHz, 2650-2656 MHz, 2662-2668 MHz, and 2674-2680 MHz frequency bands, when used for the Multipoint Distribution Service, EIRP up to 2000 watts may be authorized pursuant to section 21.904 of this part.

[2] The EIRP of stations in the 10,600-10,680 MHz band must not exceed +40 dBW.

[3] The power delivered to the antenna is limited to −3 dBW.

[4] The EIRP of stations in the 932.5-935 MHz, 941.5-944 MHz, and 10,600-10,680 MHz bands must not exceed +40 dBW.

(c) The power of each transmitter shall be maintained as near as practicable to the power input or output specified in the instrument of station authorization.

[44 FR 60534, Oct. 19, 1979, as amended at 49 FR 37775, Sept. 26, 1984; 52 FR 7140, Mar. 9, 1987; 52 FR 37783, Oct. 9, 1987; 54 FR 10328, Mar. 13, 1989; 54 FR 24905, June 12, 1989; 55 FR 46009, Oct. 31, 1990; 56 FR 57816, Nov. 14, 1991]

§ 21.108 Directional antennas.

(a) Unless otherwise authorized upon specific request by the applicant each station authorized under the rules of this part shall employ a directional antenna adjusted with the center of the major lobe of radiation in the horizontal plane directed toward the receiving station with which it communicates: *Provided, however,* Where a station communicates with more than one point, a multi- or omni-directional antenna may be authorized if necessary. New Periscope antenna systems will not, under ordinary circumstances, be authorized.

(b) Stations operating below 2500 MHz (other than stations in the Multipoint Distribution Service) which are required to use directional antennas shall employ antennas meeting the standards indicated below. (Maximum beamwidth is for the major lobe of radiation at the half power points. Suppression is the minimum attenuation required for any secondary lobe signal and is referenced to the maximum signal in the main lobe.)

Frequency range	Maximum beamwidth (degrees)	Suppression (dB)
Below 512 MHz	80	10
512 to 1000 MHz	20	13
1500 to 2500 MHz	12	13

(c) Fixed stations (other than temporary fixed stations, Multipoint Distribution Service stations, and Digital Termination Service nodal stations) operating at 2,500 MHz or higher shall employ transmitting and receiving antennas meeting the appropriate performance Standard A indicated below, except that in areas not subjected to frequency congestion antennas meeting performance Standard B may be used subject to the liabilities set forth in § 21.109(b).

ANTENNA STANDARDS

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points (included angle in degrees)	Minimum antenna gain (dBi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
932.5 to 935	A	14.0	n/a	.....	6	11	14	17	20	24
941.5 to 944	B	20.0	n/a	.....	.....	6	10	13	15	20
2,500 to 5,000	A	NA	36.0	23	29	33	36	42	55	55
	B	NA	36.0	20	24	28	32	32	32	32
5,000 to 10,550	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	38	38
10,550 to 10,565 [4]	A	3.4	34.0	20	24	28	32	35	55	55
	B	3.4	34.0	20	24	28	32	35	35	39
10,565 to 10,615	NA	360	NA	NA	NA	NA	NA	NA	NA	NA
10,615 to 10,630	A	3.4	34.0	20	24	28	32	35	55	55
	B	3.4	34.0	20	24	28	32	35	35	39
10,630 to 10,680	NA	NA	34.0	20	24	28	32	35	38	38
17,700 to 18,820	A	NA	36.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
18,920 to 19,700 [1]	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
21,200 to 23,600	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36
31,000 to 31,300 [2] [3]	NA	4.0	38.0	NA	NA	NA	NA	NA	NA	NA
Above 31,300	A	NA	38.0	25	29	33	36	42	55	55
	B	NA	38.0	20	24	28	32	35	36	36

[1] Digital Termination User Station antennas and point-to-point microwave radio station antennas in this band shall meet performance Standard B and have a minimum antenna gain of 34 dBi.

[2] The minimum front-to-back ratio shall be 38 dBi.

[3] Mobile, except aeronautical mobile, stations need not comply with these standards.

[4] Except for such antennas between 140° and 180° authorized or pending on January 1, 1989, for which minimum radiation suppression to angle (in degrees) from centerline of main beam is 36 decibles.

NOTE: Stations must employ an antenna that meets the performance standards for Category A, except that in areas not subject to frequency congestion, antennas meeting standards for Category B may be employed. Note, however, that the Commission may require the use of a high performance antenna where interference problems can be resolved by the use of such antennas.

(d) In cases where passive reflectors are employed in conjunction with transmitting antenna systems, the foregoing paragraphs of this section also shall be applicable thereto. However, in such instances, the center of the major lobe of radiation from the antenna normally shall be directed at the passive reflector, and the center of the major lobe of radiation from the passive reflector directed toward the receiving station with which it communicates.

(e) These limitations are necessary to minimize the probability of harmful interference to reception in the bands 5925-6525 MHz on board geostationary space stations in the fixed-satellite service (Part 25).

(1) *5925 to 6525 MHz.* No directional transmitting antenna utilized by a fixed station operating in these bands shall be aimed within 2 degrees of the geostationary-satellite orbit, taking into account atmospheric refraction. However, exception may be made in unusual circumstances upon a showing that there is no reasonable alternative to the transmission path proposed. If there is no evidence that such exception would cause possible harmful interference to an authorized satellite system, said transmission path may be authorized on waiver basis where the maximum value of the equivalent isotropically radiated power (EIRP) does not exceed:

(i) +47 dBW for any antenna beam directed within 0.5 degrees of the stationary satellite orbit or

(ii) +47 to +55 dBW, on a linear decibel scale (8 dB per degree) for any antenna beam directed between 0.5 degrees and 1.5 degrees of the stationary orbit.

(2) Methods for calculating the azimuths to be avoided may be found in: CCIR Report No. 393 (Green Books), New Delhi, 1970; in "Radio-Relay Antenna Pointing for controlled Interference With Geostationary-Satellites" by C. W. Lundgren and A. S. May, *Bell System Technical Journal*, Vol. 48, No. 10, pp. 3387-3422, December 1969; and in "Geostationary Orbit Avoidance Computer Program" by Richard G. Gould, Common Carrier Bureau Report CC-7201, FCC, Washington, DC, 1972. This latter report is available through the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22151, in printed form (PB-211 500) or source card deck (PB-211 501).

[44 FR 60534, Oct. 19, 1979, as amended at 50 FR 7340, Feb. 22, 1985; 51 FR 19840, June 3, 1986; 52 FR 7141, Mar. 9, 1987; 52 FR 37783, Oct. 9, 1987; 54 FR 1942, Jan. 18, 1989; 54 FR 10328, Mar. 13, 1989]

§ 21.122 Microwave digital modulation.

(a) Microwave transmitters employing digital modulation techniques and operating below 15 GHz shall, with appropriate multiplex equipment, comply with the following additional requirements:

(1) The bit rate, in bits per second, shall be equal to or greater than the bandwidth specified by the emission designator in Hertz (e.g. to be acceptable, equipment transmitting at a 20 MB/s rate must not require a bandwidth of greater than 20 MHz), except the bandwidth used to calculate the minimum rate shall not include any authorized guard band.

(2) Equipment to be used for voice transmission shall be capable of satisfactory operation within the authorized bandwidth to encode at least the following number of voice channels:

Frequency range	Number of encoded voice channels
2110 to 2130 MHz	96
2160 to 2180 MHz	96
3700 to 4200 MHz	1,152
5925 to 6425 MHz	1,152
10,700 to 11,700 MHz	1,152

(3) The required minimum number of channels shown in paragraph (a)(2) of this section may be reduced by a factor 1/N provided that N transmitters may be operated satisfactorily within an authorized bandwidth less than, or equal to, to the maximum authorizable bandwidth over the same radio path (e.g. (i) the 1152 channels requirement may be reduced to 576 if two transmitters can be satisfactorily operated over the same path within a 40 MHz maximum bandwidth for the 11 GHz band or (ii) reduced to 288 channels if four transmitters can be satisfactorily accommodated within this bandwidth). Applications submitted for equipment type acceptance designed to operate in this mode must include data which will demonstrate successful operation under typical transmission conditions. Where type accepted equipment is designed to operate on the same frequency in a cross-polarized configuration to meet the above capacity requirements, the Commission will require, at the time additional transmitters are authorized, that both polarizations of a frequency be used before a new frequency assignment is made, unless a single transmitter installation was found to be justi-

fied by the Commission at the time it authorized the first transmitter.

(b) For purposes of compliance with the emission limitation requirements of § 21.106(a)(2) of this part and the requirements of paragraph (a) of this section, digital modulation techniques are considered as being employed when digital modulation contributes 50 percent or more to the total peak frequency deviation of a transmitted radio frequency carrier. The total peak frequency deviation shall be determined by adding the deviation produced by the digital modulation signal and the deviation produced by any frequency division multiplex (FDM) modulation used. The deviation (D) produced by the FDM signal shall be determined in accordance with § 2.202(f) of Part 2 of this chapter.

(c) Transmitters employing digital modulation techniques shall effectively eliminate carrier spikes or single frequency tones in the output signal to the degree which would be obtained without repetitive patterns occurring in the signal.

(d) Transmitters type accepted for use with digital modulation prior to November 1, 1974 may continue to be used where authorized until December 31, 1976. After the latter date, such equipment will no longer be type accepted for digital modulation unless it is type accepted for such use after November 1, 1974.

(e) Microwave transmitters employing digital modulation techniques in the band 17,700-19,700 MHz shall transmit at a bit rate, in bits per second (bps), equal to or greater than the authorized bandwidth in Hertz (e.g., to be acceptable, equipment transmitting at a 20 Mbps rate must not require a authorized bandwidth greater than 20 MHz). This bps/Hz standard is independent of the antenna (polarization) used, frequency reuse, or how the system is configured.

NOTE: Until December 1, 1988, no minimum bit rate shall apply to the 17,700-19,700 MHz band. Systems authorized prior to that date may install equipment after that date with no minimum bit rate.

[44 FR 60534, Oct. 19, 1979, as amended at 46 FR 23451, Apr. 27, 1981; 49 FR 37775, Sept. 26, 1984]

§ 21.502 Frequencies.

(a) Frequencies in the bands 10,550-10,680 MHz and 17,700-19,700 MHz are available for assignment for all DEMS applicants. Assignments will consist of a pair of channels as set out in paragraphs (b), (c), (d) and (g) of this section plus internodal channels as set out in paragraphs (f) and (i) of this section.

NOTE: New applications for the assignment of channel nos. 4, 7, 9 and 19/20 in the 10,500-10,680 MHz band that have been reallocated for private DTS stations will not be accepted after September 9, 1983. Existing licensees and pending applicants are permitted to submit applications for renewal and for additional nodal and associated user stations within the SMSA for which they have applied or have been authorized for use. Applications for the assignment of frequencies in the 17,700-19,700 MHz band as indicated in paragraph (h) will be accepted only for channels 6-A, 6-B, 7-A, 7-B, 8-A,

8-B, 9-A, 9-B, 10-A, and 10-B. Channel Nos. 1-A through 5-A and 1-B through 5-B are available for assignment to private DTS stations under Part 94 rules.

(b) Applicants and licensees in the 10 GHz band may apply for an additional channel pair in that band provided the proposed channel assignments, when aggregated with any previously proposed or granted channel assignment in the 10 GHz band, would not result in the applicant or licensee being granted more than 5 MHz of bandwidth in the 10 GHz band in the SMSA, excluding internodal channels.

(c) Except as provided in (b), licensees may apply for an additional channel pair in an SMSA only when it is operating its previously authorized DTS at or near the expected capacity and the service to be provided will fully utilize all spectrum requested.

(d) Assignments in the 10 550-10 680 MHz band shall be made according to the following plan:

CHANNEL GROUP A

Channel No.	Frequency band limits MHz
1-A	10 565-10 570
2-A	10 570-10 575
3-A	10 575-10 580
4-A	10 580-10 585

CHANNEL GROUP B

Channel No.	Frequency band limits MHz
1-B	10 630-10 635
2-B	10 635-10 640
3-B	10 640-10 645
4-B	10 645-10 650

Each assignment will consist of one channel from Group A and the same numbered channel from Group B. The channel from Group A will be used for the Digital Termination Nodal Station transmitter and the channel from Group B will be used for Digital Ter-

(e) Assignments in the 10 550-10 680 MHz band shall be made according to the following plan:

CHANNEL GROUP A

Channel No.	Frequency band limits MHz
5-A	10 600.0-10 602.5
6-A	10 602.5-10 605.0
7-A	10 605.0-10 607.5
8-A	10 607.5-10 610.0
9-A	10 610.0-10 612.5
10 A	10 612.5-10 615.0

CHANNEL GROUP B

Channel No.	Frequency band limits MHz
5-B	10 665.0-10 667.5
6-B	10 667.5-10 670.0
7-B	10 670.0-10 672.5
8-B	10 672.5-10 675.0
9-B	10 675.0-10 677.5
10 B	10 677.5-10 680.0

Each assignment for operation will consist of one channel from Group A and the corresponding channel from Group B. The channel from Group A will be used for the Digital Termination Nodal Station transmitter and the channel from Group B will be used for Digital Termination User Station transmitters. The channels will be assigned in each SMSA starting with channel pair 10 and continuing downward to channel pair 5. These channels may be subdivided as desired by the licensee.

(f) The bands 10 550-10 565 MHz and 10 615-10 630 MHz are available to the Point-to-Point Microwave Radio Service. Assignments in these bands will be made according to the following plan:

CHANNEL GROUP A

Channel No.	Frequency band limits MHz
11-A	10 550.0-10 552.5

CHANNEL GROUP B

Channel No.	Frequency band limits MHz
11-B	10 615.0-10 617.5
12-B	10 617.5-10 620.0
13-B	10 620.0-10 622.5
14-B	10 622.5-10 625.0
15-B	10 625.0-10 626.25
16-B	10 626.25-10 627.5
17-B	10 627.5-10 628.75
18-B	10 628.75-10 630.0

The assignment of these channels will be in accord with the demonstrated requirement of the applicant. The preferred use of these channels is to provide internodal communications for Digital Termination Systems. All applicants for these channels shall follow the frequency coordination procedures of § 21.100(d).

(g) The bands 10,585-10,600 MHz and 10,650-10,665 MHz will be available for applicants when all the available channels have been assigned or when applications have been accepted for all available channels. Assignments in these bands will be according to the following plan:

CHANNEL GROUP A

Channel No	Frequency band limits MHz
19-A	10 585.0-10 587.5
20-A	10 587.5-10 590.0
21-A	10 590.0-10 592.5
22-A	10 592.5-10 595.0
23-A	10 595.0-10 597.5
24-A	10 597.5-10 600.0

CHANNEL GROUP B

Channel No.	Frequency band limits MHz
19-B	10 650.0-10 652.5
20-B	10 652.5-10 655.0
21-B	10 655.0-10 657.5
22-B	10 657.5-10 660.0
23-B	10 660.0-10 662.5
24-B	10 662.5-10 665.0

Licensees will be assigned one pair of channels from Group A and the corresponding pair of channels from Group B. These channels may be adjacent, if available as such. The channel from Group A will be used for the Digital Termination Nodal Station transmitter and the channel from Group B will be used for Digital Termination User Station transmitter. Each pair of channels if adjacent may be used as a single channel if licensees comply with technical standards for use of a single 5 MHz channel. Assignments will start with channels 19 and 20 and proceed upward.

(h) Digital Termination System assignments in the 18 GHz band shall be made according to the following plan:

Channel No	Nodal station frequency band (MHz)	User station frequency band (MHz)
30	18.870-18.880	19.210-19.220
31	18.880-18.890	19.220-19.230
32	18.890-18.900	19.230-19.240
33	18.900-18.910	9.240-19.250
34	18.910-18.920	19.250-19.260

These channel pairs will be assigned in each SMSA and may be subdivided as desired by the licensee.

(i) Internodal link assignments are to be made in accordance with the provisions of Subpart I of Part 21, applying to point-to-point operations.

[46 FR 23451, Apr. 27, 1981, as amended at 47 FR 29245, July 6, 1982; 48 FR 50330, Nov. 1, 1983; 49 FR 37775, Sept. 26, 1984; 52 FR 37784, Oct. 9, 1987]

§ 21.503 Frequency stability.

(a) In the frequency band 10,550-10,680 MHz the frequency stability of each Digital Termination Nodal Station transmitter authorized for this service shall be ±0.0001%. The frequency stability of each Digital Termination User Station transmitter authorized for this service shall be ±0.0003%.

(b) In the frequency band 17,700-19,700 MHz the frequency stability of each Digital Termination Nodal Station transmitter authorized for this service shall be ±0.001%. The frequency stability of each Digital Termination User Station transmitter authorized for this service shall be ±0.003%.

[49 FR 37775, Sept 26, 1984]

§ 21.506 Transmitter power.

(a) For stations operating in the 10.550-10.680 MHz band, the following restrictions apply:

(1) The output power of a Digital Electronic Message Service nodal transmitter shall not exceed 0.5 watt per 250 kHz. Further, each application shall contain an analysis demonstrating compliance with § 21.107(a).

(2) The output power of a Digital Electronic Message Service user transmitter shall not exceed 0.04 watts per 250 kHz.

(3) The transmitter power in terms of the watts specified in this section is the peak envelope power of the emission measured at the associated antenna input port.

(4) Operating power shall not exceed the authorized power by more than ten (10) percent of the authorized power in watts at any time.

(b) For stations operating in the 17,700-19,700 MHz band the transmitter output power will be governed by § 21.107 of this rule part. Further, each application shall contain an analysis demonstrating compliance with § 21.107(a).

[48 FR 50331, Nov. 1, 1983]